PHYTOTOXICOLOGY SECTION INVESTIGATION IN THE VICINITY OF DATE INDUSTRIES LIMITED AYR, ONTARIO AUGUST 13, 1989

FEBRUARY 1991

Ontario
Environment
Environnement

92-01659/

ISBN 0-7729-8038-1

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DATE INDUSTRIES LIMITED, AYR, ONTARIO

AUGUST 13, 1989

Report prepared by:

Phytotoxicology Section
Air Resources Branch
Ontario Ministry of the Environment

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log 90-2231-064
PIBS 1440

1 Background

The Date Industries facility in Ayr is a scrap iron foundry which melts approximately 20 tons of scrap iron per day. The Cambridge District Office of the Ontario Ministry of the Environment has received complaints against the company with regard to particulate fallout since 1970. The foundry has a 15m cupola stack and has two baghouse type dust collector systems in operation. A 1988 report by the District office (OME, 1988) cited problems with stack emissions and with fugitive emissions from the plant. Phytotoxicology Section Staff conducted an assessment survey in 1989 at the request of the West Central Regional Office of the Ontario Ministry of the Environment.

2 Methods

On August 13, 1989, Marius Marsh of the Phytotoxicology Section sampled silver maple foliage from trees at 8 stations in the vicinity of the Date smelter in Ayr, as well as at a reference site in Victoria Park in Ayr. Figure 1 shows the locations of sampling sites. All samples were collected using standard Phytotoxicology sampling techniques (O.M.E., 1983). Samples were delivered to the Phytotoxicology Section sample processing laboratory in Toronto where they were dried and ground before being submitted to the Laboratory Services Branch Trace Inorganics Laboratory for chemical analysis. Since this was the first phytotoxicology survey of the facility, a metal scan, as well as analyses for some non-metals, was conducted on the samples in order to determine which contaminants might be present as a result of the foundry's activities.

3 Results

The results for copper, lead, zinc, iron, manganese, aluminum, sodium and strontium are presented in Table 1. Results for nickel, arsenic, cadmium, cobalt, chromium, molybdenum, antimony, selenium, and vanadium showed, at most, only trace amounts present.

Figure 1: Station Locations for Foliar Sampling,
Date Industries, Ayr. August 13,1989.

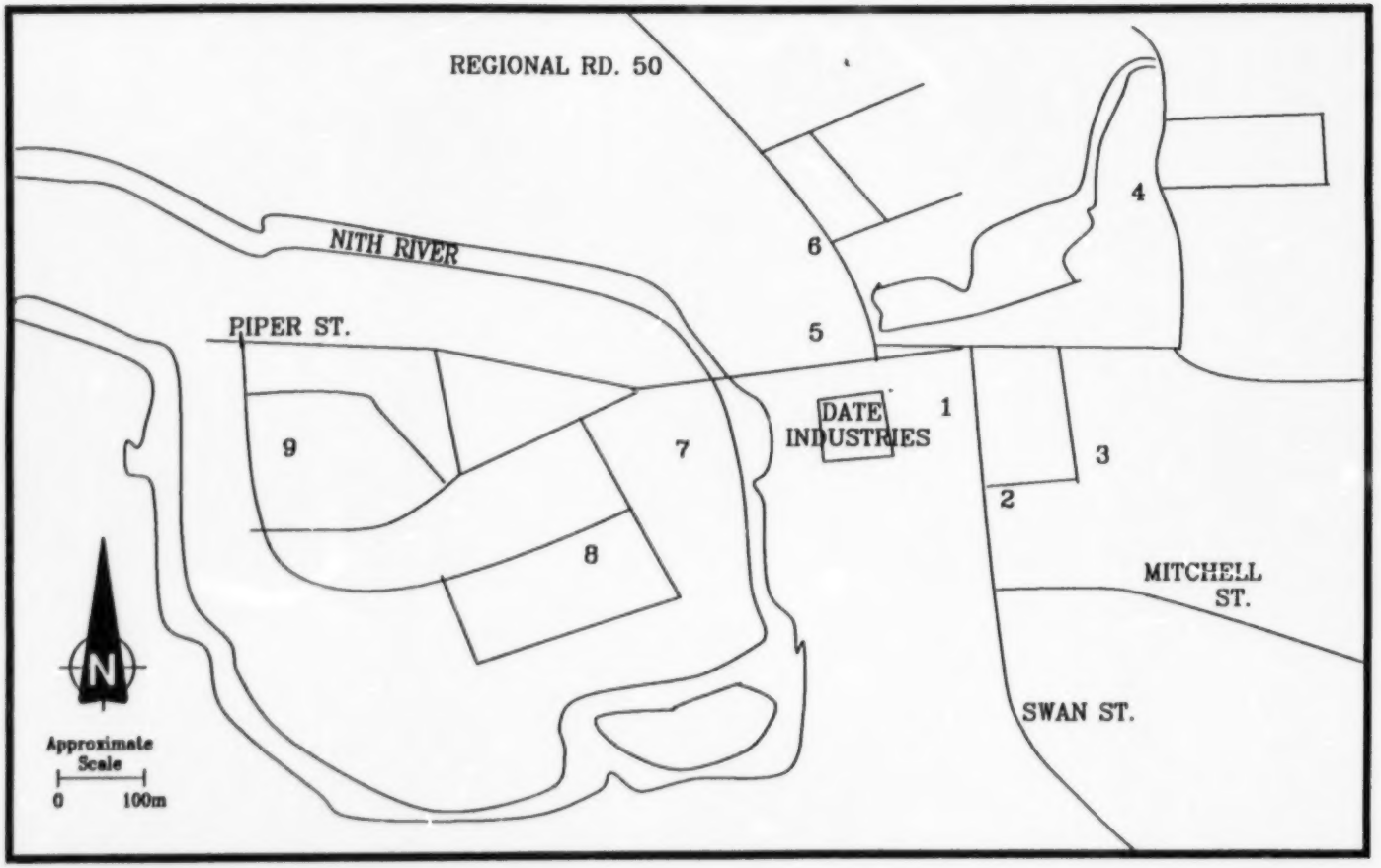


Table 1. Elemental Concentrations (ppm) in Foliage in the Vicinity of Date Industries Ltd., Ayr, Ont. Aug 13, 1989.

Station	Cu	Pb	Zn	Fe	Mn	Al	Na	St
1	5.0	7.2	49	467	31	132	152	23
2	6.6	2.1	34	176	65	50	12	35
3	1.5	1.5	14	120	22	54	13	10
4	4.1	0.7	27	80	43	40	6	26
5	6.3	2.2	89	253	27	59	7	23
6	5.3	2.3	39	146	30	56	13	34
7	5.1	2.5	37	247	18	57	9	27
8	6.2	1.0	33	173	30	46	6	8
9	4.1	0.8	28	108	67	48	6	9
ULN[1]	20	30	250	500	-	500	50	-

[1] Upper Limit of Normal for rural foliage (unwashed). See Appendix 1 for explanation.

In order to understand the spacial distribution of some of these elements in relation to the foundry, concentrations of iron, lead, copper, and zinc were plotted using a contour mapping program (Surfer, ver. 2.0). These contour maps, which are shown in figures 2, 3, 4, and 5, give an indication of a potential pattern of distribution of the specific contaminant; however, they should be interpreted with care since accuracy is only known at the nine sampling stations.

4 Discussion

The only element for which foliar concentrations approach the Upper Limits of Normal in the vicinity of the foundry is iron. Figure 2 clearly indicates the high concentrations to be centered on the vicinity of the Date Industries foundry, with the highest concentrations occurring to the east of the plant following the prevailing winds in the area. This implicates the foundry to be a source of contamination, and is supportive of the numerous complaints regarding particulate matter being emitted from the foundry. Iron at these concentrations would not be expected to produce phytotoxic effects. Although concentrations of other metals are not excessive with respect to known ranges in Ontario, the contour mapping technique also clearly shows there to be a source of lead and zinc, although a minor one in the immediate vicinity of the foundry. The foliar zinc distributions would indicate that the main source for zinc emissions may be different than that for iron and lead, since station #5 has higher values than station #1. For example, zinc contamination may be resulting from fugitive emissions more than from stack emissions, whereas iron and lead contamination results primarily from stack emissions.

Figure 2: Contour Map of Foliar Iron Concentrations in Silver Maple.
August, 1989.

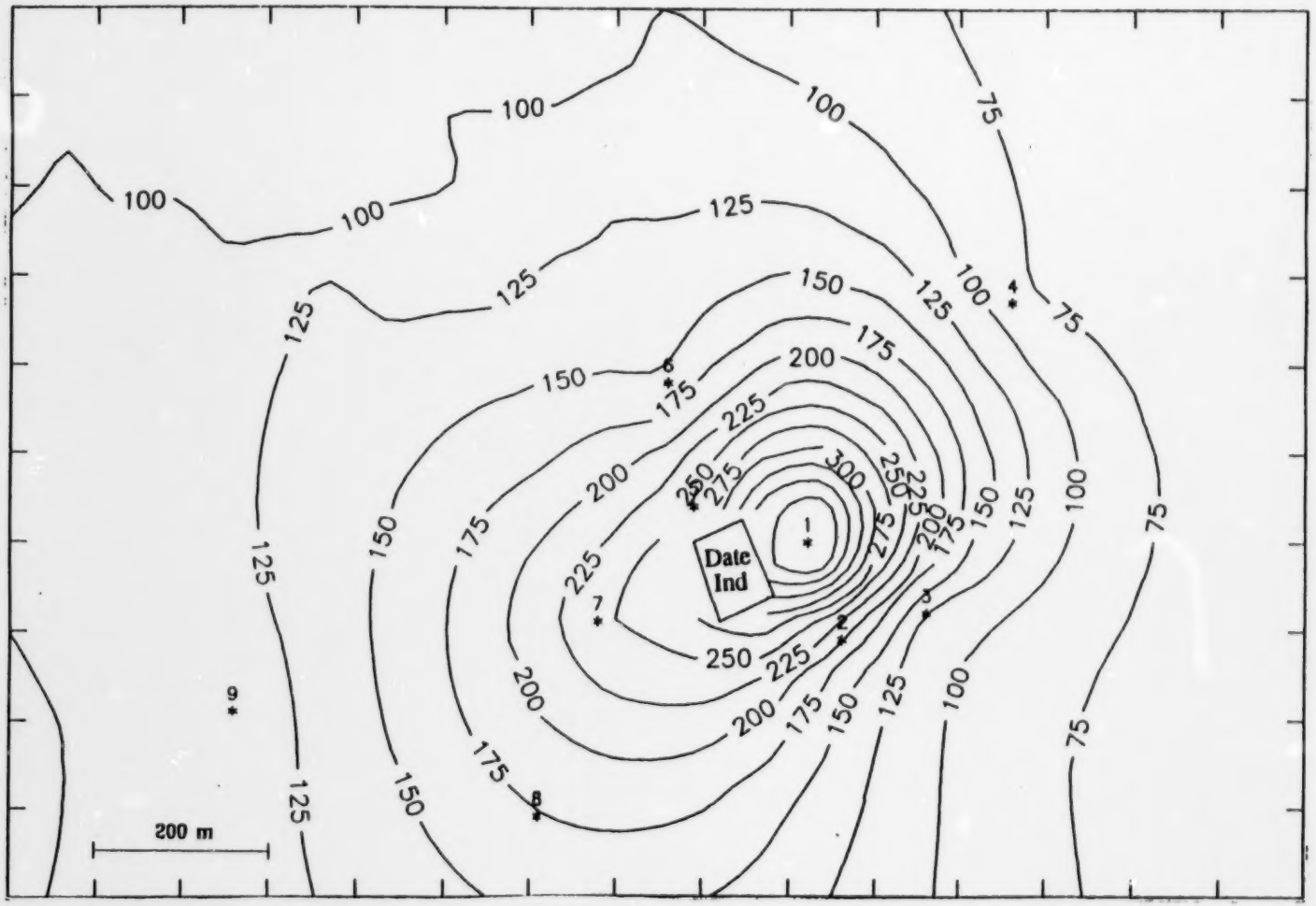


Figure 3: Contour Map of Foliar Lead Concentrations in Silver Maple.
August, 1989.

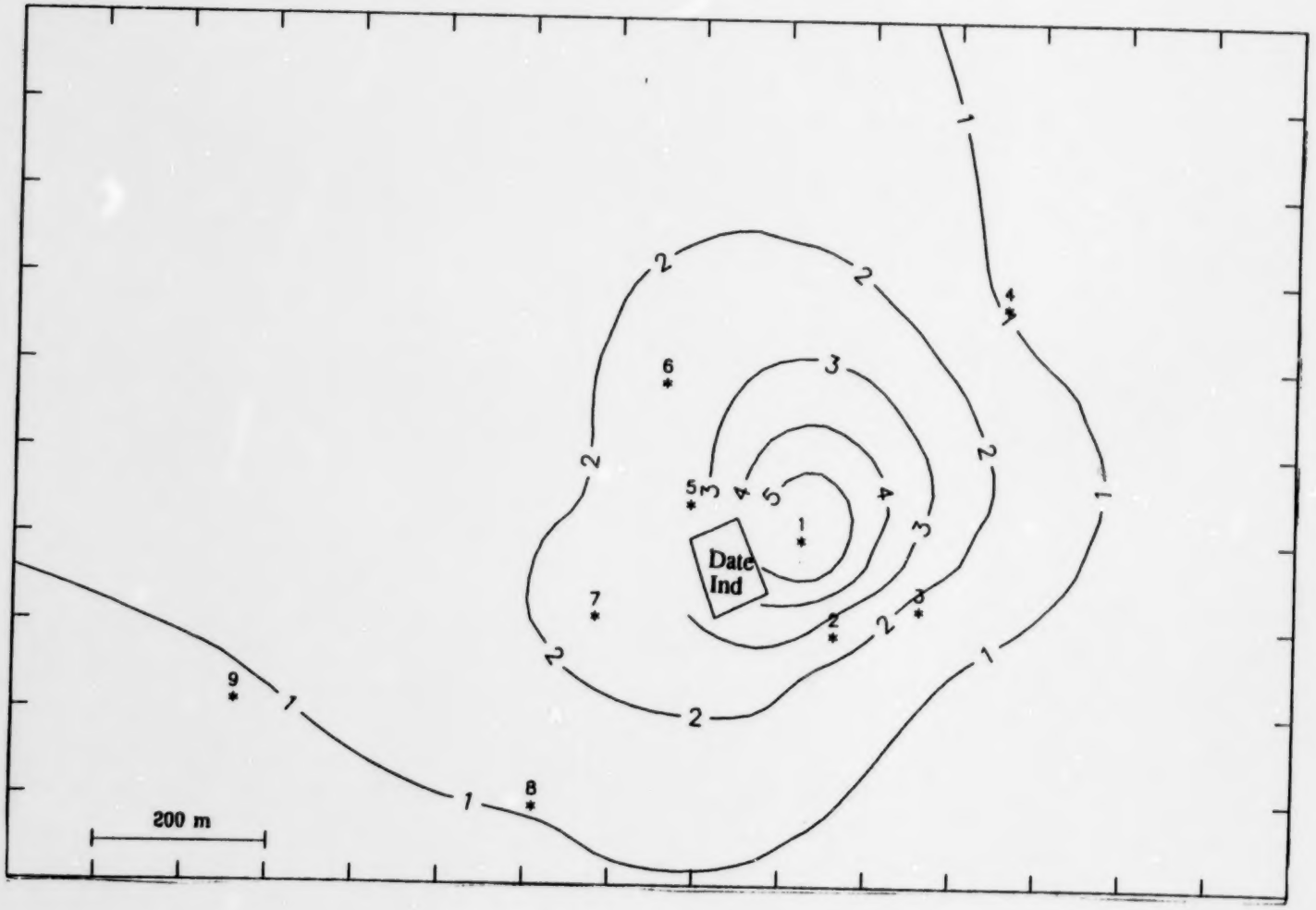


Figure 4: Contour Map of Foliar Zinc Concentrations in Silver Maple.
August, 1989.

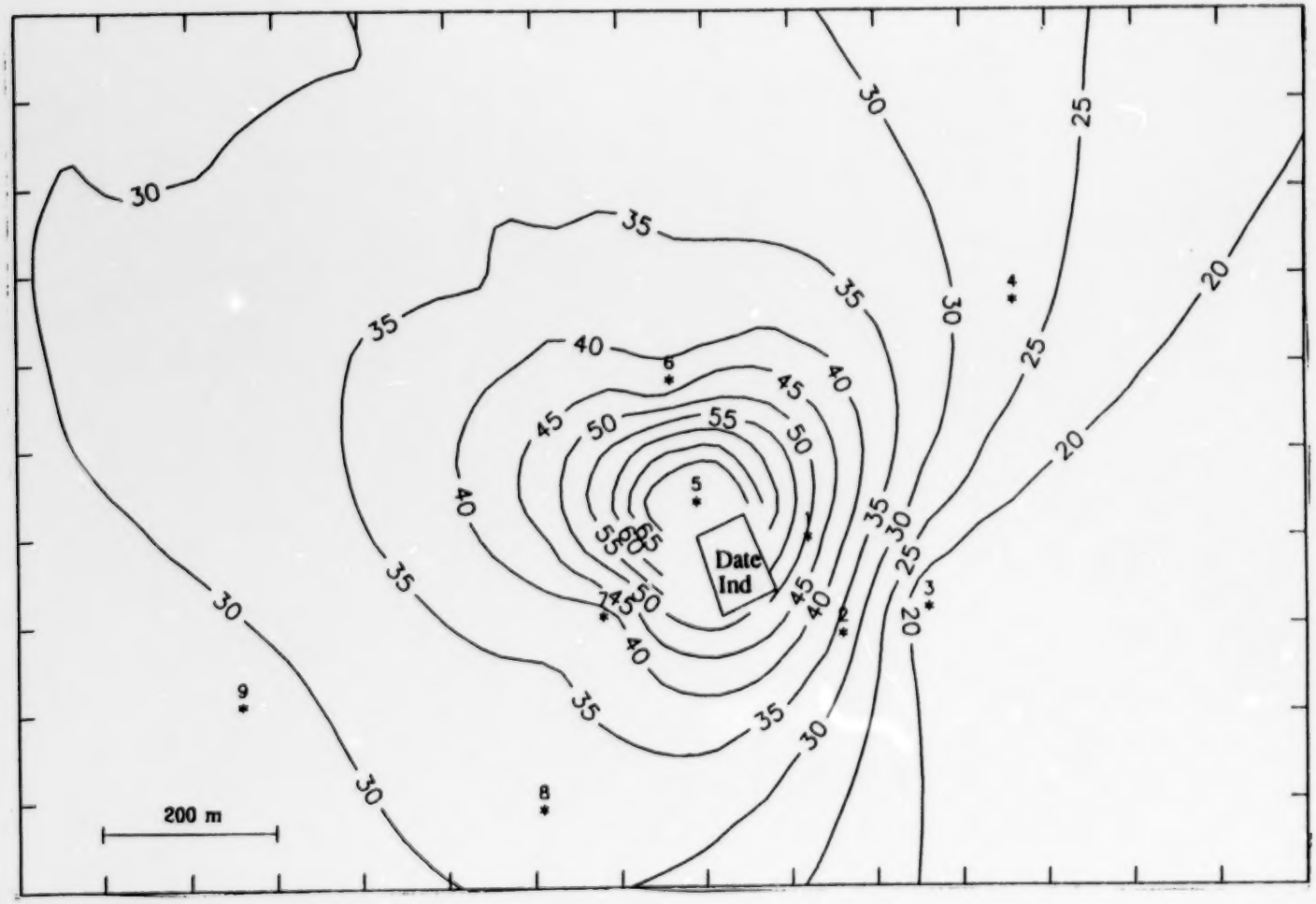
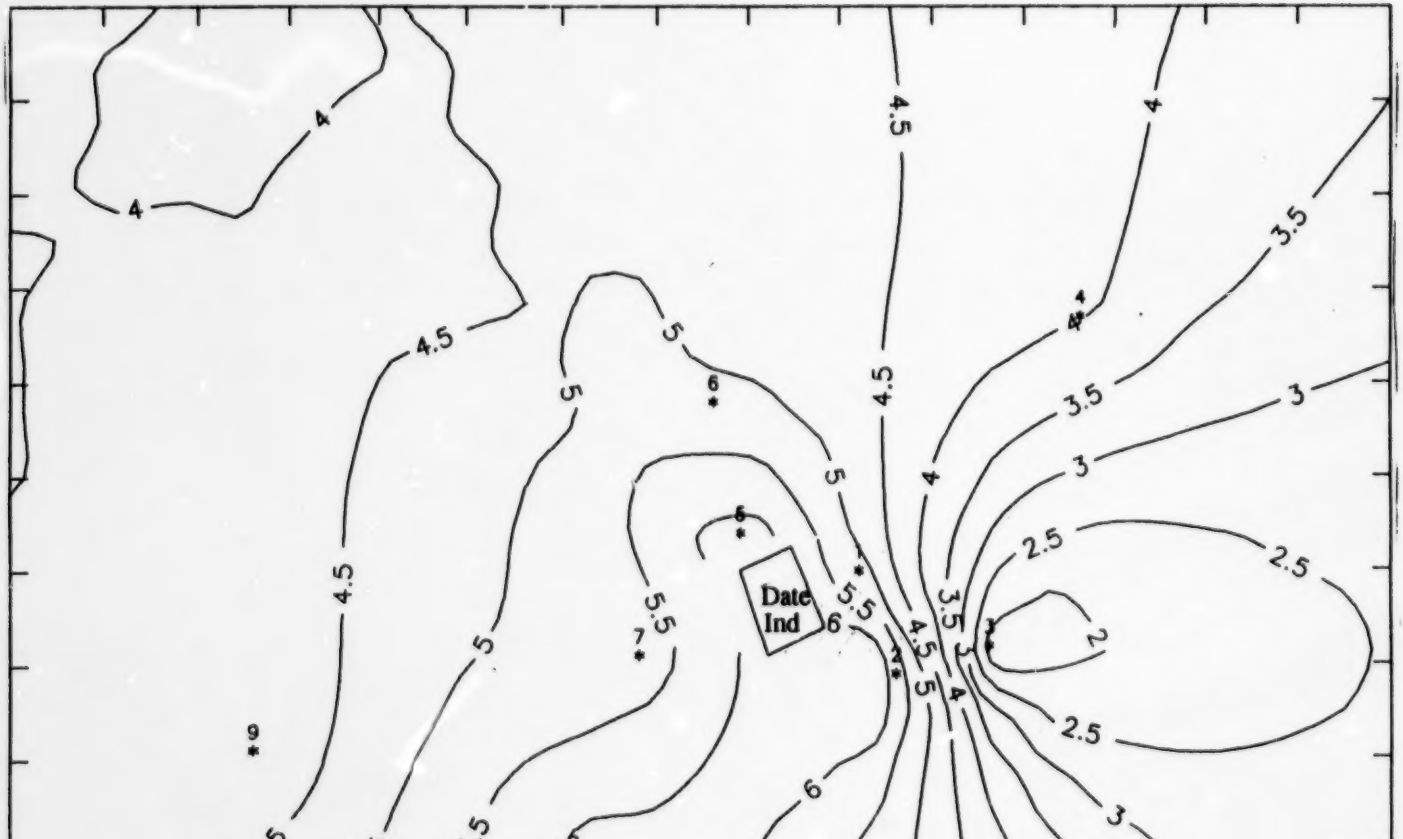


Figure 5: Contour Map of Foliar Copper Concentrations in Silver Maple.
August, 1989.



Foliar sodium concentrations are very high at Station #1, immediately east of the foundry. This results from one of the two trees at this site having very high concentrations, while the other tree exhibits normal concentrations of sodium. Since none of the other sites display elevated sodium concentrations, this anomaly would appear to be due to a factor independent of the foundry, such as salt from the driveway or the road.

4 Summary

Analyses of foliar samples from Silver Maple in the vicinity of the Date Industries foundry in Ayr indicate that the foundry is a source of limited iron contamination of vegetation. Contour mapping of foliar concentrations of other elements indicate the foundry to be a minor source of lead and zinc.

5 Appendices

5.1 Explanation of OME "Upper Limits of Normal" Contaminant Guidelines

Interpretation of concentrations were made based on "Upper Limit of Normal" (ULN) guidelines established by the Phytotoxicology Section, Air Resources Branch (OME, 1989). The ULN was determined by examining an extensive database for soils and vegetation samples collected at sites removed from any point source of contamination. Statistical tests were applied to the data to calculate the ULN value. This ULN value would not normally be exceeded in 99 samples in 100 for background areas. Values which exceed the ULN are considered likely to have resulted from contamination. Values which exceed the ULN do not necessarily imply that the element is toxic at that level. Concentrations which are below the guidelines are not known to be toxic.

It is stressed that the ULNs do not represent maximum desirable or allowable levels of contaminants, but rather serve as guidelines which, if exceeded, flag situations requiring further investigation to determine the significance of the above normal concentrations. Comparisons of sample elemental concentrations with those from control or reference areas may also serve to flag such situations at contaminant concentrations lower than the ULNs.

5.2 References

Ontario Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section, Air Resources Branch; Technical Support Sections - NE and NW Regions.

Ontario Ministry of the Environment, 1988. Section 126 Survey, Date Industries Limited, Ayr, Ont. May 1988 prepared by R.McKnight, West Central Region, Cambridge, Ont.

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